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Louisiana Resiliency

Shona M. Gibson, PE

FEMA Region 6

Loss Avoidance Study
Seeing is Believing!

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Loss Avoidance Study Terminology

Basic terms and acronyms:

LAS:	Loss Avoidance Study
BFE:	Base Flood Elevation
FFE BM:	First Floor Elevation Before Mitigation
FFE AM:	First Floor Elevation After Mitigation
GRE:	Ground Elevation (from sea level)
EABF	Elevation Above Base Flood
HWM:	High-water mark
Flood Depth:	Inundation depth in dwelling from FFE
BRV:	Building Replacement Value
BRC:	Building Repair Costs
LAR:	Loss Avoidance Ratio
Freeboard:	Height of FFE above BFE

Note: With the exception of “Flood Depth”, all measurements in a Loss Avoidance Study are expressed in standardized NAVD88 values, based on the GRE of the given location.

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USGS – FEMA Partnership

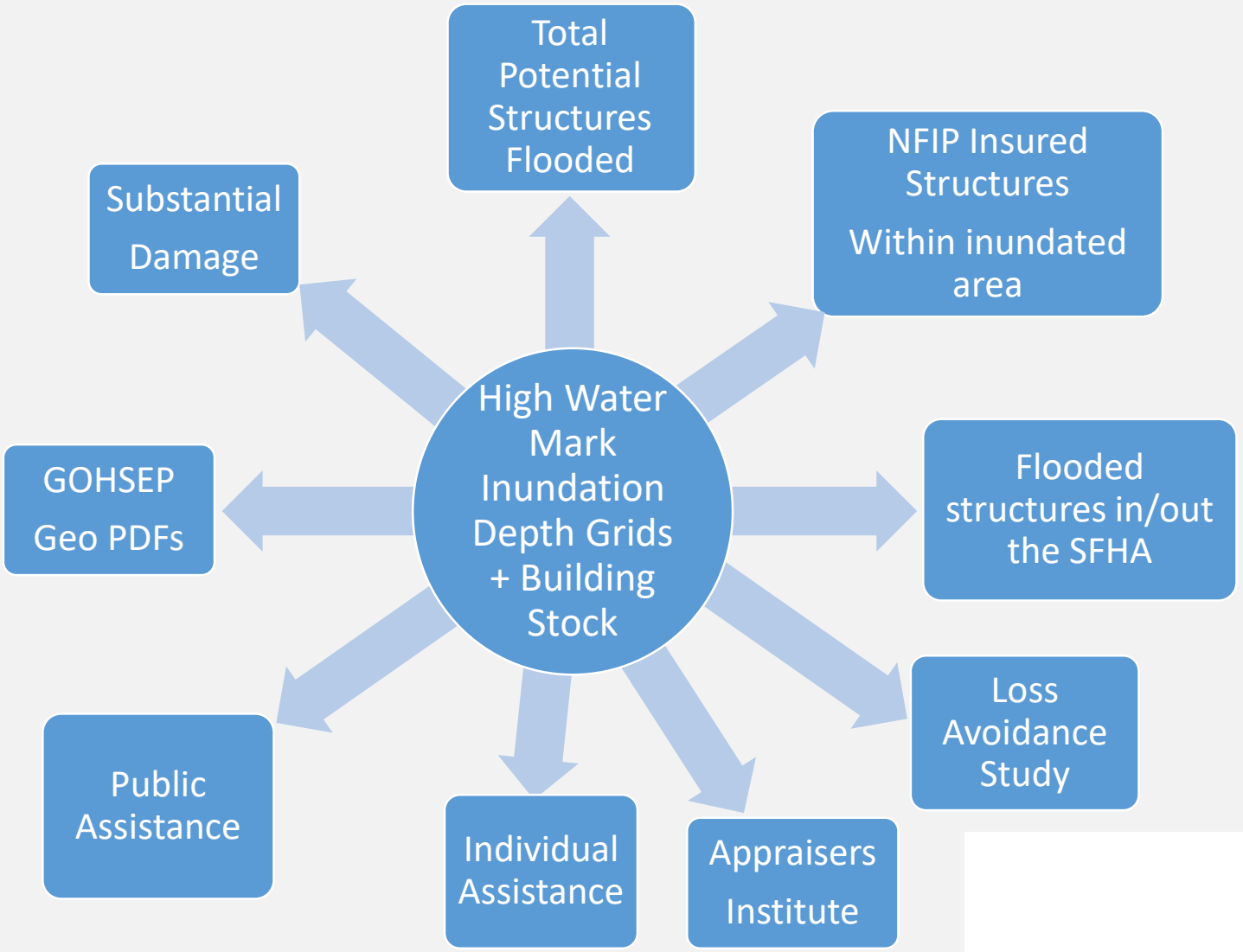
- High Water Mark collection initiated during regional response before disaster declaration due to perishable nature of data.
- FEMA initiates mission assignment to USGS to flag & survey high watermarks
- Follow up after disaster declaration and recovery operations begin to process the high water marks , perform indirect discharge measurements, gauge analysis and develop a comprehensive report along with the Inundation Maps & Depth Grids.

BUT THIS TAKES TIME

What do we do with initial information in the meantime?

- Real time flagging & surveying of High water mark allows JFO Hazard & Performance Analysis Specialists to do a very preliminary processing of the data to develop a preliminary inundation map & depth grid to be used to inform several missions.

USGS – FEMA Partnership

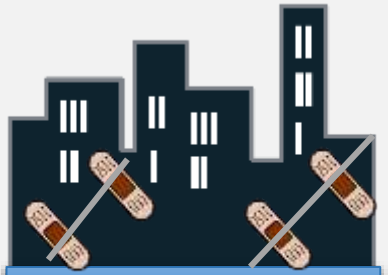


Loss Avoidance Study

Before and After Mitigation

Losses avoided are determined by taking a technical assessment of an mitigated property and determining what would have happened to it during a hazard event, in this case a flood event, had the property not been mitigated. The losses avoided are determined in dollars.

Total Losses Avoided



Building Repair Cost

+

Content Damage Cost

+

Displacements Cost

=

Total Losses Avoided

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Loss Avoidance Study
Why Mitigate?

Since 1980:

- Louisiana has suffered 22 declared flood disasters (riverine or coastal) and 16 hurricanes or tropical storms (38 events in 36 years)
- The National Flood Insurance Program (NFIP) paid out $16.21 billion
- Repetitive loss claims (at least 2 paid flood losses in 10 year period) totaled $3.16 billion

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Loss Avoidance Study
Why Conduct LAS?

- Since Hurricane Katrina, $1.45 billion has been invested in Hazard Mitigation projects
- LASs provide hard data to validate the success of mitigation measures and the losses avoided
- LASs demonstrate the effectiveness of existing mitigation measures
- LASs give evidence to justify future funding for similar projects

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Loss Avoidance Study
DR-4263 and DR-4277

In 2016, back to back severe riverine flooding provided an opportunity to evaluate and analyze HM effectiveness in two events and demonstrate the cumulative benefits of mitigation

- Statewide, approximately 800 properties had been flooded over the past 20 years, and then mitigated using HMGP funds
- 571 of these were in areas flooded in March or April (or both)
- Of these, 183 met the basic requirements for inclusion in the study: the mitigation project was complete, and the property had been “tested” by flooding

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LAS Methodology

Pre-conditions for valid study data

- A hazard event has to have taken place
- The mitigation project (elevation or acquisition) must have been completed prior to the event that “tests” the mitigated project
- For flood events, a high water mark (HWM) must be verified
- Pre-mitigation finished floor elevations (FFE) must be known or determined, especially for elevations
- Post- mitigation finished floor elevations must be verified (elevation projects only)

From the above data, a pre-mitigation flood depth can be calculated – the flood depth that would have occurred had the property not been elevated or acquired

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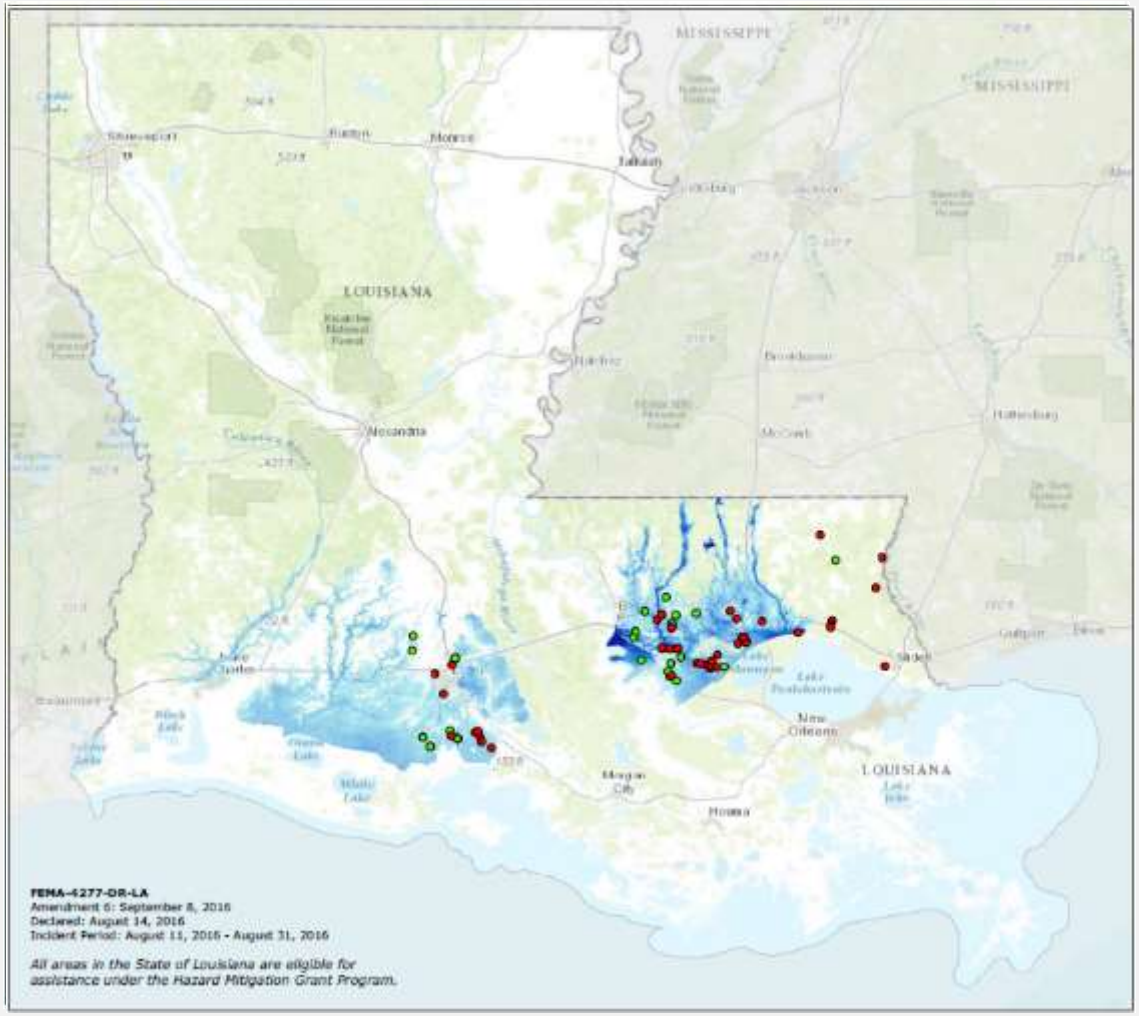
LAS Methodology

Identifying Areas for Study – 4263



Mitigated Properties identified within areas flooded during 2016 Flood Events

March
266 inspected
72 met the basic criteria for inclusion the study.

August
294 inspected
111 met the basic criteria for inclusion in the study

Site inspections were conducted to verify:

- Mitigation project completed
- Mitigation efforts tested

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Loss Avoidance Study
DR-4263 and DR-4277

- 72 locations were flooded during 4263
  - 43 elevation projects
  - 29 acquisition projects
- 111 locations were flooded during 4277
  - 63 elevation projects
  - 48 acquisition projects
- 36 of the 183 were affected by both events

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LAS Methodology

Case Study #387 — Livingston Parish

Before Mitigation

After Mitigation

FFE-AM:12.63

BFE: 8’

March HWM: 7.06’

FFE-BM: 3.63

GRE: 3.3’

FFE-AM:12.63

August HWM: 8.96’

BFE: 8’

FFE-BM: 3.63’

GRE: 3.3’

Mitigation Cost = $156,921

LAS Methodology

Calculating Displacement Costs

- **Displacement Costs =**

  Daily Lodging and Meals x Displacement Days

- **Displacement costs are based on:**
  - An average household size of 2.55 persons (2010 Census).
  - GSA per-diem rates for lodging and meals in affected areas.

    The per-diem for these case studies was $89 a day for lodging and $51 per person, per day, for meals.

    Total Per Diem Costs = $89 + ($51 X 2.55) = $219
  - Displacement days

    Displacement days are based on a Damage Depth Function.

    March Flood Depth = 3.43’
    Displacement Days= 154

    August Flood Depth = 5.33’
    Displacement Days= 240

Calculating Number of Displacement Days

Flood Depth in Feet	Displacement in Days
0	0
1	45
2	90
3	135
4	180
5	225
6	270
7	315
8	360
9	405
10	450
11	495

Source: HM HPA Methodology Handbook

March: Displacement Costs = $219 x 154**= $33,734** Displacement Costs Avoided

August:Displacement Costs = $219 x 240**= $52,572** Displacement Costs Avoided

$86,306 Total Displacement Costs Avoided

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LAS Methodology

Calculating Content Replacement Costs

- **Contents Value**

The "contents" value of the property is the dollar value of furniture, clothes, appliances that were damaged or destroyed

is calculated as a percentage of the BRV, taking into consideration the size and flood depth of damage

= BRV x Flood Depth of Damage for Contents

March Flood Depth = 3.43'
Percent Damaged = 23.59%

August Flood Depth = 5.33'
Percent Damaged = 29.69%

Calculating Content Damage Percentage

Flood Depth in Feet	1-Story w/o Basement Percent Damaged	2-Story w/o Basement Percent Damaged
0	8.1	5.0
1	13.3	8.7
2	17.9	12.2
3	22.0	15.5
4	25.7	18.5
5	28.8	21.3
6	31.5	23.9
7	33.8	26.3
8	35.7	28.4
9	37.2	30.3
10	38.4	32.0
11	39.2	33.4

Source: HM HPA Methodology Handbook

March: CV = $301,174 x .2359 **= $71,047** Contents Losses Avoided
August: CV = $301,174 x .2969 **= $89,419** Contents Losses Avoided

$160,465 Total Contents Losses Avoided

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LAS Methodology

Calculating Building Repair Costs

- **Building Replacement Value (BRV) =**

  Pre Mitigation Sq. Footage x Actual new Construction Cost
  (Obtained from RS Means)

  New Construction Cost for Affected Area =$103.17 per SF

  Case Study BRV =
  2919 SF x $103.17= $301.174

- **Building Repair Costs (BRC) =**

  BRV x Damage Percentage
  (calculated from collected data)

  March Flood Depth = 3.43'
  Percent Damaged = 43.11%

  August Flood Depth = 5.33'
  Percent Damaged = 54.98%

Calculating Residential Building Depth Damage Percentage

Flood Depth in Feet	1-Story w/o Basement Percent Damaged	2-Story w/o Basement Percent Damaged
0	13.4	9.3
1	23.3	15.2
2	32.1	20.9
3	40.1	26.3
4	47.1	31.4
5	53.2	36.2
6	58.6	40.7
7	63.2	44.9
8	67.2	48.8
9	70.5	52.4
10	73.2	55.7
11	75.4	58.7

Source: HM HPA Methodology Handbook

March: BRC = $301,174 x .4311 **= $129,836** Building Repair Losses Avoided

August: BRC = $301,174 x .5498 **= $165,585** Building Repair Losses Avoided

$265,232 Total Building Repair Losses Avoided

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LAS Methodology
Calculating Total Losses Avoided

Case Study #387 Livingston Parish Total Losses Avoided

As a result of a successful mitigation project, the total *losses avoided* are:

March

Property would have flooded 3.43’ if not mitigated

1. Building Repair Cost: $129,839
2. Contents Losses Cost: $71,047
3. Displacement Cost: $33,734

Total Losses Avoided: **$234,617**
Cost Of Mitigation: **$156,921**

Loss Avoidance Ratio = $\frac{\text{Losses Avoided}}{\text{Cost of Mitigation}}$

Loss Avoidance Ratio = $\frac{\$234,617}{\$156,921} = 1.50$

August

Property would have flooded 5.33’ if not mitigated

1. Building Repair Cost: $165,585
2. Contents Losses Cost: $89,419
3. Displacement Cost: $52,572

Total Losses Avoided: **$307,576**
Cost of Mitigation: **$156,921**

Loss Avoidance Ratio = $\frac{\text{Losses Avoided}}{\text{Cost of Mitigation}}$

Loss Avoidance Ratio = $\frac{\$307,576}{\$156,921} = 1.96$

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Loss Avoidance Study

LA March and August 2016

Summary

Event	Cost of Mitigation	Average Flood Depth in Ft	Total Losses Avoided	Loss Avoidance Ratio
Elevations				
4263	$ 7,370,259	3.10	$ 6,303,127	0.86
4277	$ 9,926,783	2.44	$ 9,763,784	0.98
Combined Totals	**$ 17,297,041**	**2.77**	**$ 16,066,911**	**0.93**
Acquisitions				
4263	$ 4,912,179	3.11	$ 4,675,169	0.95
4277	$ 7,706,198	2.37	$ 6,168,561	0.80
Combined Totals	**$ 12,618,377**	**2.74**	**$ 10,843,730**	**0.86**
Totals	**$ 29,915,419**	**2.76**	**$ 26,910,641**	**0.90**

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LAS Methodology
Loss Avoidance Ratio

Loss Avoidance Ratio (LAR) =
Total Losses Avoided / Mitigation Cost

- A LAR *greater-than-one* indicates that mitigation benefits have exceeded project costs
- Each disaster event is calculated independently
- The initial LAR reflects only one instance during the useful life of a project, and increases over time, assuming multiple events
- 30 years elevation useful life. 100 years useful life acquisitions
- Over time, projects will potentially pay for the mitigation costs many times over
- In 2016, there were **36 properties** that would have been flooded by 2 separate flooding events had they not been mitigated, allowing us to calculate the cumulative effect of mitigation efforts

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Loss Avoidance Study
Cumulative Benefits

Calculating the Cumulative Benefits Realized After Multiple Events

Because the Cost of Mitigation is a one-time expense, the Total Losses Avoided and Loss Avoidance Ratio increase when a property is exposed to more than one disaster. For our test case:

$$\text{Cumulative Loss Avoidance Ratio (LARc)} = \frac{\text{March Losses Avoided + August Losses Avoided}}{\text{Cost of Mitigation}}$$

March

1. Building Repair Cost: $129,839
2. Contents Losses Cost: $71,047
3. Displacement Cost: $33,734

Total Losses Avoided: $234,620
Loss Avoidance Ratio = 1.50

August

1. Building Repair Cost: $165,585
2. Contents Losses Cost: $89,419
3. Displacement Cost: $52,572

Total Losses Avoided: $307,576
Loss Avoidance Ratio = 1.96

Cost of Mitigation = $156,921

$$\text{LARc} = \frac{\$234,620 + \$307,576}{\$156,921} \qquad \frac{\$542,196}{\$156,921} = \mathbf{3.46}$$

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Loss Avoidance Study

LA March and August 2016

Summary

Event	Cost of Mitigation	Average Flood Depth in Ft.	Total Losses Avoided	Loss Avoidance Ratio
Elevations				
4263	$ 7,370,259	3.10	$ 6,303,127	0.86
4277	$ 9,926,783	2.44	$ 9,763,784	0.98
Combined Totals	**$ 17,297,041**	**2.77**	**$ 16,066,911**	**0.93**
Acquisitions				
4263	$ 4,912,179	3.11	$ 4,675,169	0.95
4277	$ 7,706,198	2.37	$ 6,168,561	0.80
Combined Totals	**$ 12,618,377**	**2.74**	**$ 10,843,730**	**0.86**
0 Cost of Mitigation August Event	($5,652,313)			
Totals	**$ 24,263,106**	**2.76**	**$ 26,910,641**	**1.11**
Totals	**$ 29,915,419**	**2.76**	**$ 26,910,641**	**0.90**

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Loss Avoidance Study

Results Over Time

Event	Number of Projects	Cost of Mitigation	Average Flood Depth in Ft.	Total Losses Avoided	Loss Avoidance Ratio
Elevations					
Isaac	95	$ 10,199,828	2.43	$ 8,230,845	0.81
4263	43	$ 7,370,259	3.10	$ 6,303,127	0.86
4277	63	$ 9,926,783	2.44	$ 9,763,784	0.98
Elevation Project Totals	**201**	**$ 27,496,869**		**$ 24,297,756**	**0.88**
Acquisitions					
4263	29	$ 4,912,179	3.11	$ 4,675,169	0.95
4277	48	$ 7,706,198	2.37	$ 6,168,561	0.80
Acquisition Project Totals	**77**	**$ 12,618,377**		**$ 10,843,730**	**0.86**
Cumulative Totals	**278**	**$ 40,115,247**		**$ 35,141,486**	**0.88**
Zero Cost of Mitigation 4277		**$ (5,652,313)**			
Totals Adjusted for Both Events	**278**	**$ 34,462,934**		**$ 35,141,486**	**1.02**

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Loss Avoidance Study
Additional Freeboard Benefits

Event/Parish (# of Projects)	Cost of Mitigation	Average Flood Depth in Feet	Total Losses Avoided Elevating to BFE	Losses Avoided with Increased FFE-AM
4263				
Ascension (3)	$ 406,679.00	4.38	$ 218,139.33	$ 387,933.47
Livingston (11)	$ 1,164,017.00	2.85	$ 830,573.65	$ 1,358,170.37
St.Tammany (2)	$ 667,975.00	2.87	$ 402,304.75	$ 547,163.36
Tangipahoa (2)	$ 739,645.00	6.64	$ 878,392.81	$ 967,452.67
4277				
Ascension (5)	$746,756.19	6.27	$ 570,951.59	$ 995,481.38
Livingston (27)	$3,939,031.00	4.04	$ 2,748,706.68	$ 4,608,492.68
Tangipahoa (1)	$240,970	1.67	$ 89,215.97	$ 191,204.18
Total	**$ 7,905,073.19**	**4.10**	**$ 5,738,284.78**	**$ 9,055,898.11**

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LAS Methodology

Case Study #387 — Livingston Parish

Without Mitigation:	House Elevated to BFE:	House Elevated 4.63’ Above BFE
Total Losses: **$307,576**	Total Losses: **$118,031**	Total Losses: **$0**

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Loss Avoidance Study

Over time, mitigation projects have consistently proven themselves to:

- Be cost-effective
- Have long-term benefits
- Strengthen the economic base
- Protect lives and property
- Build community resiliency
- Provide homeowners with hope and confidence for the future

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Loss Avoidance Study

Adaptation works, great strides are being made to increase individual resiliency.

Louisiana has a long track record of successful building elevation and acquisition.

- $25 million in losses avoided during the recent flooding as a result of prior mitigation investment.
- When factoring losses calculated in Isaac, data shows over $34 million in losses avoided

However, focus is shifting to efforts to increase overall community resiliency with strategies that positively impact greater population with same dollars

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Moving Towards Watershed Regionilism

Due to 2016 events the Governor's Office expressed a desire to look at alternatives to structure-by-structure mitigation, acknowledging the need to consider projects and pathways that increase overall community resiliency.

- In his September, Louisiana Gov. John Bel Edwards requested funds to implement large-scale flood control structures to reduce risk at a watershed level.
- Pat Forbes, director of the Louisiana Office of Community Development (OCD), declared that the state would like to examine a range of mitigation activities, including green infrastructure and water retention.

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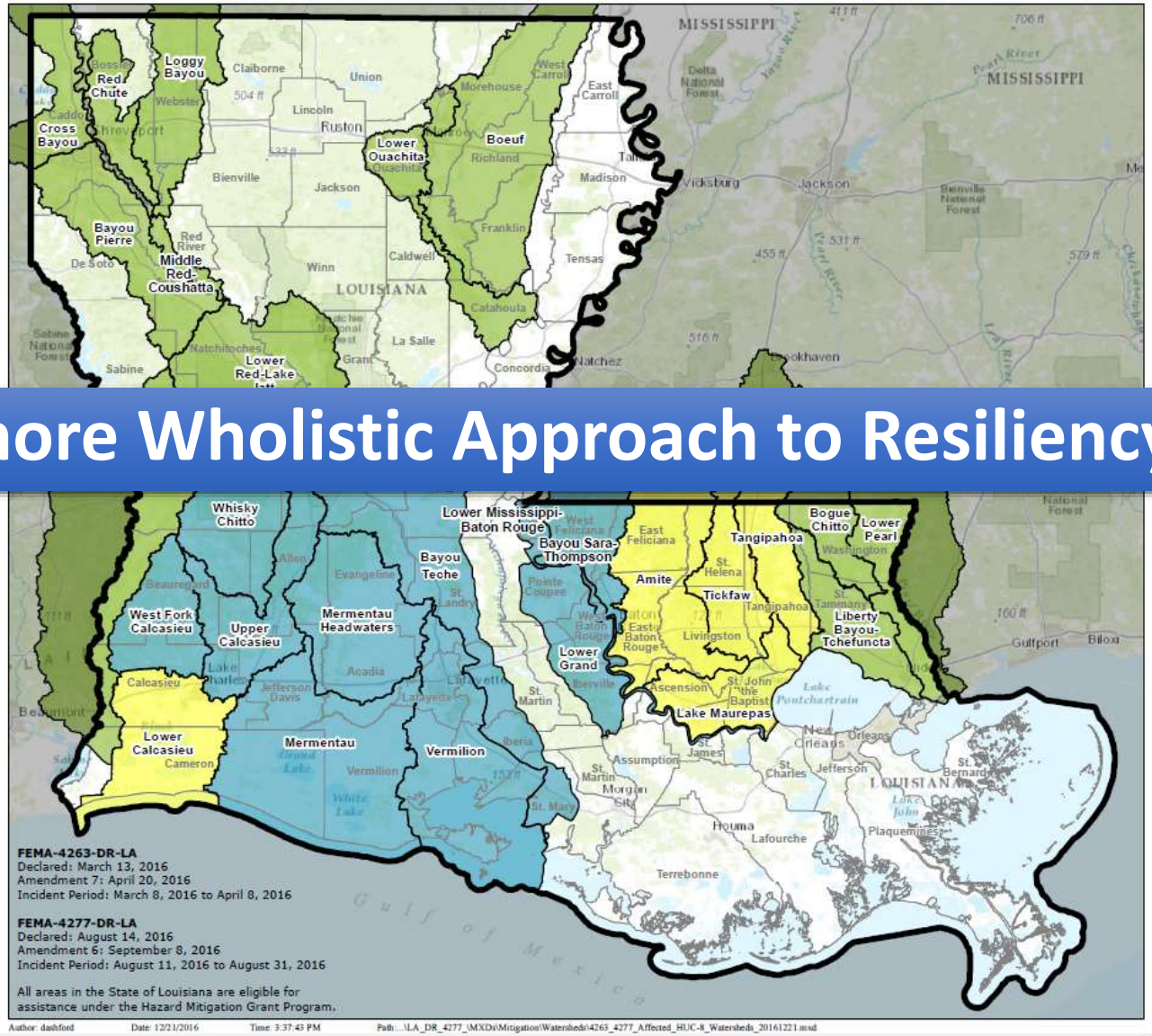
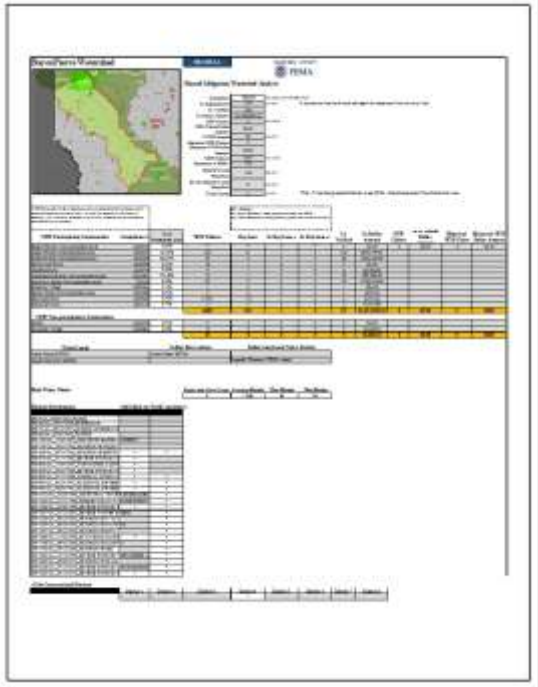
Watershed Regionalism

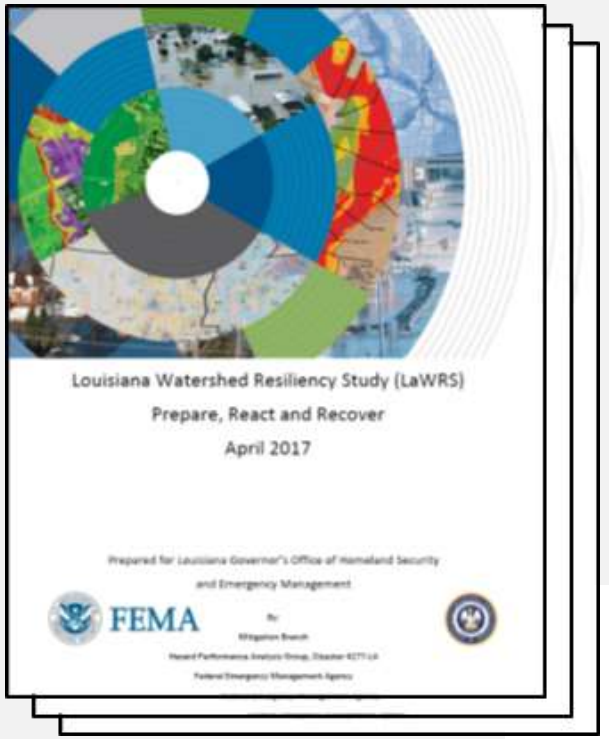


A more Wholistic Approach to Resiliency

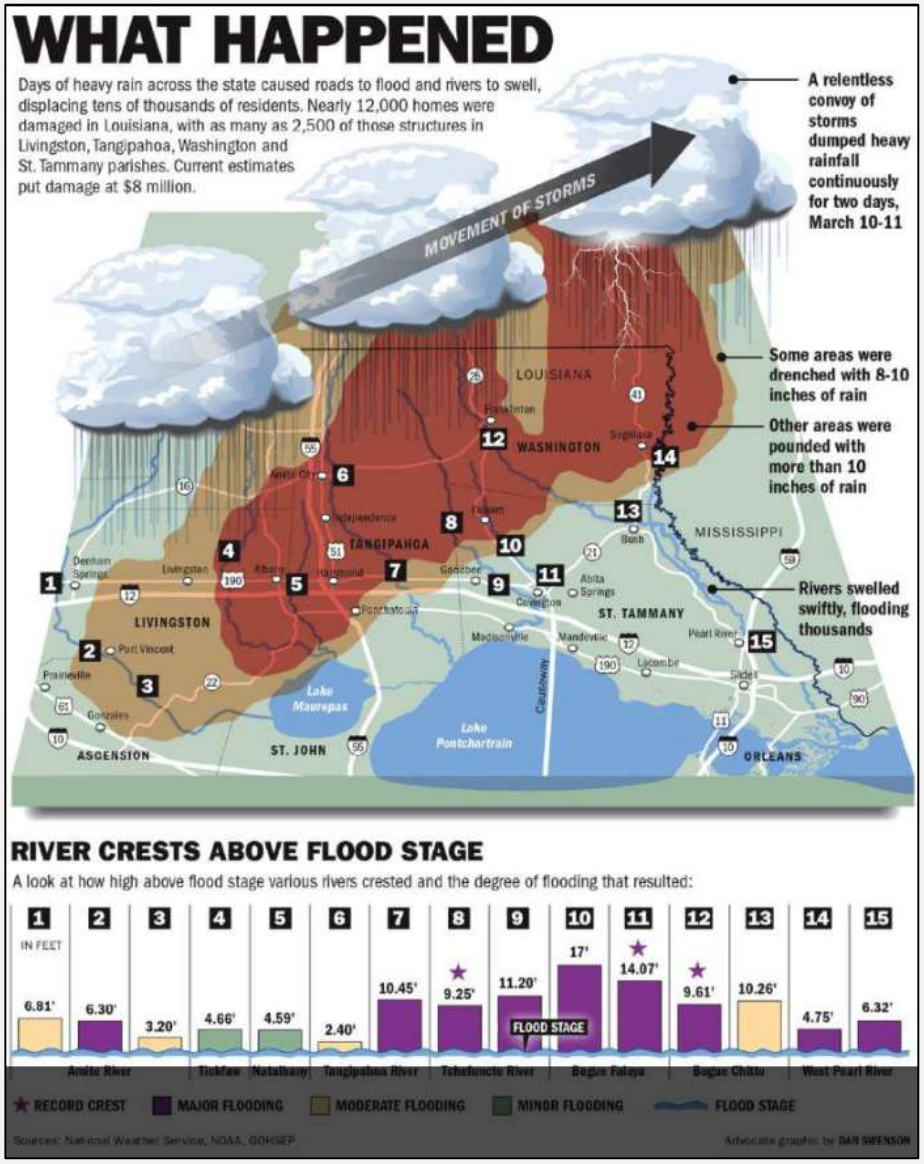
Watershed Regionalism

At state's request, JFO Mitigation hazard and Performance Analysis Team to perform 27 watershed studies on the watershed affected by March and August Events.





Watershed Regionalism



Watershed Studies:

- Provide a data driven suite of products to aid the state, local communities and other stakeholders in developing risk informed recovery strategies at a watershed level
- Comprehensive evaluation of the conditions, issues and unmet needs in areas affected by chronic, severe or episodic flooding.
- Describes impacts on infrastructure buildings, population along the river and in its watershed.
- Evaluates past & ongoing impacts of floods, storms & climate on people and neighborhoods to illustrate where watershed planning investments can prevent or reduce the disruption and cost of natural events

Watershed assessments are not:

- Hydrological or Hydraulic assessment or models on the watershed or any of it's tributaries

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Process Framework

Primary	Secondary	Others
• % Of Structures Impacted • Land Cover Changes • Master and Community Plans • Upstream Watersheds • Population • NFIP Claims 4263 • NFIP Claims 4277 • IA Registration 4263 • IA Registration 4277 • Levee/Dams/Flood Control • Transportation Network • Channel Conditions • H&H Studies • Critical Facilities	• Emergency Facilities • % of Floodplain / Flooding • Previous 404 • Non-Disaster Grants / Other Agency Grants • Geology • Topography / Elevation • Aquifers / Waterwells • Economics • Economics / Median Income • Endangered Species • Soils • Energy Infrastructure – Oil Gas • Energy Infrastructure – Electric • Parks and Recreation • Climate and Precipitation • Census	• Watershed / Subwatershed • Snapshot • Repetitive Loss • Social Vulnerability Index • Superfund/Brownfield Sites • Building Codes/Freeboard • Demographic Summary (Snapshot II)

Watershed Regionalism

In order to preserve our Louisiana for future generations, we must learn from our past & incorporate that knowledge in our planning and construction in order to effect change in the recovery that is happening right now

Jeffrey Giering, Louisiana State Hazard Mitigation Officer

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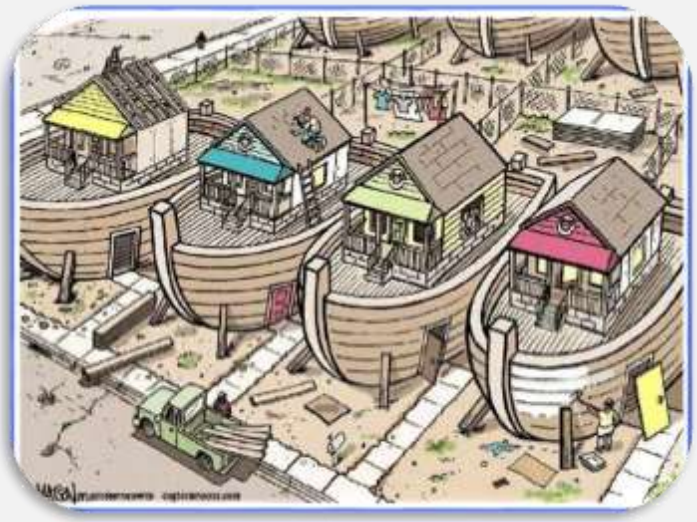
Tomorrow's Floodplain is here TODAY!

Questions?



Loss Avoidance Study

The Team

Shona M. Gibson, PE
Civil Engineer
FEMA Region 6
Shona.Gibson@fema.dhs.gov
940-383-7326

Back Row:

Kenita Julien Winston Glover Henry Snow Steve Robinson Alan Johnson Keith McCarron Evelyn Tirado

Front Row:

Don Christian Carlos Lopez-Caraballo Shona Gibson Justin Guy Jim Zemlicka